

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau



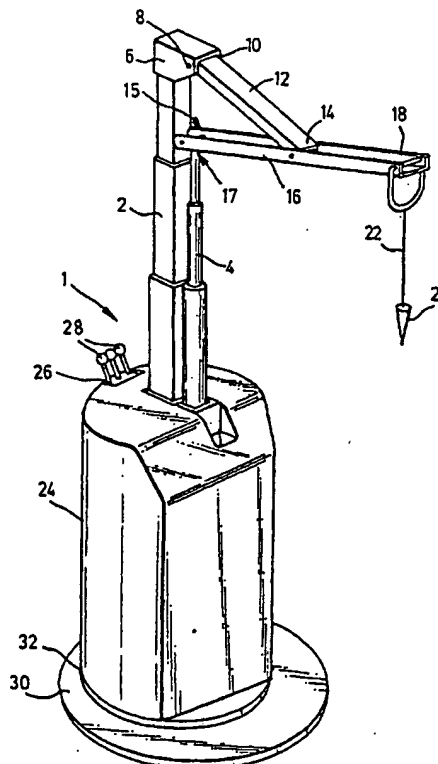
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁷ : A61G 7/10, B66F 9/06, B66C 23/48</p>	<p>A1</p>	<p>(11) International Publication Number: WO 00/67690 (43) International Publication Date: 16 November 2000 (16.11.00)</p>
<p>(21) International Application Number: PCT/GB00/01764 (22) International Filing Date: 8 May 2000 (08.05.00) (30) Priority Data: 9910437.4 7 May 1999 (07.05.99) GB (71)(72) Applicant and Inventor: RENTON, Andrew, Lamont [GB/GB]; 34 Frogston Road West, Edinburgh EH10 7AJ (GB). (74) Agents: MCCALLUM, William, Potter et al.; Cruikshank & Fairweather, 19 Royal Exchange Square, Glasgow G1 3AE (GB).</p>		<p>(81) Designated States: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p>Published With international search report.</p>

(54) Title: LIFTING APPARATUS

(57) Abstract

The present invention provides a lifting apparatus with variable and independently selectable height and reach which comprises a base (24) supporting a lifting means (2, 4) etc. The lifting means comprising two upwardly extending variably extendible support means (2, 4); an arm (16) having a proximal end portion and an intermediate portion, which are pivotally connected to an upper end portion of respective ones of said variably extendible support means (2, 4); and a load support means (22) depending from a distal end portion (18) of the arm (16). Each of the variably extendible support means (2, 4) is provided with drive control means formed and arranged for extending and retracting each of the variably extendible support means (2, 4) relative to each other for controlling translational movement of the arm (16) wherein the reach and elevation of the lifting apparatus may be altered substantially independently of each other by selective extension and/or retraction of each of the variably extendible support means (2, 4) whereby a load can be selectively and independently moved in generally vertically and/or horizontally extending directions.



BEST AVAILABLE COPY

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

-1-

Lifting Apparatus

The present invention relates to a lifting apparatus, more particularly a lifting apparatus which is suitable for
5 operating within confined spaces or areas such as between beds in a hospital ward.

Lifting apparatus are used in hospitals and hospices and the like to facilitate movement of patients onto and off of beds,
10 trolleys, wheelchairs and into and out of baths.

In general lifting apparatus of this type take the form of fixed structures located above the bed or bath. The lifting apparatus comprises a mechanically or manually operable pulley
15 system from which depends a harness for securing to a patient during lifting. The pulley system is movable horizontally along rails which are generally fixed to a wall adjacent the bed/bath.

20 The main disadvantages of lifting apparatus of this type is that they are fixed (to a wall or may be free standing frame secured to the floor) and are not readily relocatable without first dismantling the apparatus, which is obviously undesirable and time consuming.

25

Mobile lifting apparatus are also used in hospitals to provide support to a patient to be lifted. These generally lift through a single arcuate pathway which presents difficulties in lifting patients onto and off of beds, or trolleys, or into
30 and out of baths.

Lifting aids of this type are generally unsuitable for patients who are unable to grip the lifting apparatus with at least one hand or who lack comprehension and are totally non
35 self-weight-bearing. Furthermore, in use, lifting aids of

-2-

this type may require one person to operate the lifting aid
another provides additional support to the patient.

It is an object of the present invention to minimise or
5 obviate one or more of the foregoing disadvantages.

The present invention provides a lifting apparatus which is
capable of variable and independently selectable height and
reach and is particularly suitable for use in lifting patients
10 in and out of beds, trolleys, wheelchairs and into and out of
baths in hospitals and hospices and the like, which lifting
apparatus comprises a base supporting a lifting means, said
lifting means comprising at least two upwardly extending
variably extendible support means; an arm having a proximal
15 end portion and an intermediate portion, which portions are
pivotally connected, directly or indirectly, to an upper end
portion of respective ones of said variably extendible support
means; and a load support means depending from a distal end
portion of the arm, said variably extendible support means
20 being provided with drive control means formed and arranged
for extending and retracting said variably extendible support
means relative to each other for controlling translational
movement of the arm such that the reach and elevation of the
lifting apparatus may be altered substantially independently
25 of each other whereby a load depending from the distal end of
said arm can be selectively and independently moved in
generally vertically and/or horizontally extending directions.

Various forms of drive control means may be used.
30 Conveniently there may be pressurised fluid (hydraulic or
pneumatic), single or double-acting, rams provided with drive
means such as pressurised fluid pumps and control means such
as valve systems. The pressurised fluid rams may moreover
have two, three or more concentrically arranged telescopically
35 extendible sections. Additionally, where the pressurised
fluid rams have two or more sections, then the ram of one (or

-3-

more) of said two or more sections can be locked in a desired position by a locking means while the remaining section(s) can be extended and/or retracted as desired. Preferably, at least one of said at least two upwardly extending variably extendible support means is a double-action ram.

Alternatively there may be used rack and pinion or winch and pulley systems with drive means such as an electric motor or a direct drive system such as a linear motor, and control means may be electronic circuit systems. Naturally microprocessor systems may also be included in the control systems.

It will be appreciated that the apparatus may be readily provided in different sizes with various operating parameters, notably range of horizontal and vertical movement, and maximum reach and maximum elevation of the load support means.

Conveniently the variably extendible support means are formed and arranged to provide a maximum elevation of the load support means in the range of from 1.5 to 3.0 m.

The footprint shape of the base can be of any configuration such as generally circular, polygonal (regular or irregular), e.g. hexagonal, square or triangular. The shape of the base is preferably cylindrical so as to avoid angular edges which may cause an injury to a user or patient.

25

The base of the lifting apparatus may be provided with powered and/or unpowered wheels or other similar means to facilitate relocation/transportation of the lifting apparatus in a loaded or unloaded condition.

30

The arm typically has a length of from 0.5 to 2.0 m, preferably from 1.0 to 1.6 m. The arm is desirably fabricated from a material which has a relatively high tensile strength to permit safe lifting of patients with body-weights which may be up to 100 to 150 kg or more. Suitable materials are steel,

-4-

especially high tensile steel, DURALUMIN (Trade Mark) and other high tensile alloys.

Conveniently there may be provided an extension attachment
5 which is formed and arranged to be connected to the distal end of the arm to provide additional reach. The extension attachment may also be provided with similar support apparatus as for the arm such as a support harness or releasable fastening (such as a karabiner). A similar extension
10 attachment may also be provided for attachment to the uppermost end of each of the variably extendible support means.

It will be appreciated that the base should generally be
15 configured to ensure that the lifting apparatus does not over-balance in use with an intended load. In general the base is formed and arranged so that together with said support means, it provides sufficient counter-balancing for any intended load. Conveniently there may be included in the base counter-
20 weight or ballast means.

The drive control means conveniently is provided with a user interface in the form of a control panel located on the base. Alternatively, the user interface may be a remote control
25 device linked to the variably extendible drive means via suitable wiring or other communication means such as radio, infra-red, or microwave transceivers.

An on-board power pack may conveniently be provided within the
30 base and preferably comprises a system of rechargeable battery power cells. Advantageously, the power pack is provided with an integral charging device such that the battery power cells can be re-charged directly from a mains power supply..

35 The drive control means is desirably of at least sufficient power to produce a lifting capacity of at least 150 kg, and

-5-

advantageously 200 kg or more, when the arm is fully extended (and any variably extendible support means is also extended to its maximum extent).

5 In a preferred form of the present invention, the arm is directly and pivotally connected to the respective upper end portions of the at least two variably extendible support means.

10 Desirably said at least two variably extendible support means comprise at least one each of a main variably extendible support means and a secondary variably extendible support means whereby the main variably extendible support means provides the main load bearing support for the lifting
15 apparatus.

Preferably, the main variably extendible support means provides the main load bearing support for the arm via a support link which is pivotally connected across the upper end
20 of the main variably extendible support means and said intermediate portion of the arm. The said secondary variably extendible support means is pivotally connected to a proximal end portion of the arm. The height and reach of the lifting apparatus may be varied by altering the degree to which the
25 main and secondary variably extendible support means are extended relative to each other.

In a preferred form of the present invention provided with said support link, the variably extendible support means (main
30 and secondary) and the arm may be retracted and stowed within said base of the lifting apparatus by extending the main variably extendible support means to its fullest extent while simultaneously retracting the secondary variably extendible support means, said arm pivots downwardly about its non-distal
35 end (attached to said upper end portion of the secondary variably extendible support means) to a final resting position

-6-

where said arm lie flush against along its length against the secondary variably extendible support means such that the main and secondary variably extendible support means and the arm are substantially parallel to each other; both the main and 5 the secondary variably extendible support means may then fully retracted by the drive control means within said base of the lifting apparatus.

When the apparatus does not require the extending arm to be 10 fully retracted, the coupling between the ram and the arm can be of the permanent fixed coupling type. Where it does require to be retracted then a pivot pin connecting the hydraulic ram to the arm, must disconnect from the arm. This may be done in different ways but one preferred way would be 15 to have the jaws of pivot pin engaging catches provided on the arm formed and arranged so that they are forced open under the power of the pin's movement. The jaws may be locked around the pin using a cotter pin and/or heavy duty leaf spring and/or a resiliently biased piston on one (or possible both) side(s) of 20 the pin catch.

Various kinds of support means at the distal end of the arm may be used, including, inter alia, a support harness or the like such as those commonly used in hospitals for lifting 25 patients in and out of wheelchairs, baths, beds and onto/off of trolleys. Alternatively, the support means may be a hook or releasable fastener such as a karabiner for attachment to a support harness or the like.

30 The base may be supported on a turntable or the like such that the lifting apparatus can be rotated through a full rotation or part thereof. The turntable is conveniently controlled through the same user interface as the drive control means. Additionally or alternatively the lifting apparatus may be 35 provided with a plurality of stabiliser legs or stays which can be extended in use of the apparatus when required to

-7-

provide additional security against overbalancing. The stabilising legs or rods may be integral parts of the base or turntable or may be connected thereto by conventional means such as by welding or by being bolted into place.

5

The scope of use of the lifting apparatus is not intended to be strictly limited to use in hospitals and the like, and it is intended that the apparatus may be used in a wide variety of environments such as in warehouses where space is limited
10 or on construction sites where there are frequently relatively heavy loads to be lifted and/or moved.

The present invention will now be further described with particular reference to the following specific examples and
15 drawings which are provided by way of illustration.

Fig. 1 shows a perspective view of the lifting apparatus according to one preferred aspect of the present invention;

20 Fig. 2 shows a side view of the apparatus similar to that of Fig. 1 ; and

Fig. 3 illustrates the retractable nature of the lifting means.

25

Fig. 4 is a schematic detail vertical section through the pivotal connection of the arm to the secondary extensible support;

30 Figs. 5 and 6 are transverse sections corresponding to Fig. 4 showing complete and partial disengagement thereof, respectively; and

Fig. 7 is a schematic hydraulic circuit suitable for an
35 apparatus of the invention.

-8-

A lifting apparatus as shown in Fig.1 according to one preferred aspect of the present invention is generally referred to by the reference number 1.

5 The lifting apparatus 1 has a pair of vertically extending parallel variably extendible support means 2 and 4 which are the main and secondary variably extendible support means respectively. The variably extendible support means 2 and 4 are in the form of three part hydraulically powered rams. The
10 main variably extendible support means 2 is load bearing and is larger in diameter than the secondary variably extendible support means 4 which is substantially non-load bearing. Located at the upper end portion 6 of the main variably extendible support means 2 is a pivot point 8 to which is
15 connected one end 10 of a support link 12. The support link 10 is pivotally connected at its other end 14 to the mid-portion of an arm 16. The proximal end 15 of the arm 16 is pivotally connected 42 to the upper end portion 17 of the secondary variably extendible support means 4. The arm 16 has
20 a distal end 18 from which depends a load 20 suspended by a wire cable 22.

The variably extendible support means 2 and 4 extend vertically from the top of a substantially cylindrical body
25 portion 24 of the lifting apparatus 1. The front (adjacent and facing the load to be lifted) of the body portion 24 is planar and thereby provides a greater area for manoeuvring of a load to be lifted and/or moved.

30 A control panel 26 located on the upper rearward facing portion of the body portion 24. The control panel 26 has two control levers 28 for use in controlling the operation and movement of the lifting apparatus 1.

35 The body portion 24 is supported on and rotatably connected to a circular base section 30 via a turntable 32. The base

-9-

section 30 has a larger footprint area than the body portion 24 resting thereon so as to provide stability to the lifting apparatus 1 during lifting operations.

5 In order to show a change in the reach of the lifting apparatus without any change in the height of the load 20, Fig. 2 shows the relative starting positions of the arm 16 and the support link 12 as indicated by solid lines (the dashed lines and reference numerals 12', 16' and 20' relate to the 10 support link, the arm and the load respectively in their final relative positions). The reach of the lifting apparatus is reduced without changing the height of the load 20 supported, by retracting the secondary variable extendible support means 4 while the primary variable extendible support means 2 is not 15 moved. The load 20 is move closer to the body portion 24 of the lifting apparatus 1.

Battery power pack 34 resting upon a hydraulic power unit 36 is located within the body portion 24. The battery power pack 20 and hydraulic power unit are formed and arranged conventionally (not shown) to provide power to the lifting apparatus 1.

Wheels 38, 40 located under the base section 30 are shown in 25 dashed outline in Fig. 2. The wheels 40 are steerable and are operated (from the control panel 26, Fig. 1) by electric motors (not shown) which are powered electrically from the battery power pack 34 and are provided with brakes (also not shown).

30

The primary and secondary variably extendible support means 2 and 4 are shown in a partially retracted state within the body section 24 such that the arm 12 (Fig. 3) abuts along its length against the primary variably extensible support means 35 2. The primary and secondary variably extendible support

-10-

means 2 and 4 and the arm 12 can then be fully withdrawn inside the body portion 24.

Figs. 4 to 6 show some preferred forms of pivotal connection 5 42 of the arm 16 to the secondary variably extendible support means 4. In more detail the upper end 43 of the secondary variably extendible support means 4 has a transversely extending pivot pin 44 which is captively engaged at each end in a pin catch 45. Each pin catch 45 comprises a fixed jaw 46 10 and a hinged 47 jaw 48, which is biased into a closed position by a strong leaf spring 49. The opposed inner faces 50 of the jaws 46, 48 are shaped so that the pivot pin 44 can be driven from a fully disengaged position shown in Fig. 5, inbetween the jaws 46, 48, forcing them apart as shown in Fig. 4 15 allowing the jaws 46, 48 to close together around it under the influence of the leaf spring 49. Similarly the pivot pin 44 can be pulled out from between the jaws 46, 48 when the arm 16 is held in its collapsed condition by the fully extended main extendible support 2 while the secondary variably extendible 20 support 4 is fully retracted.

In order to ensure against any unintentional disengagement of the pivotal connection 42 in use of the apparatus for lifting or lowering of a load, the pin catch 45 is desirably provided 25 with a locking mechanism to secure the hinged jaw 48 in its closed position. Thus, for example, there may be used a removable or retractable locking pin 50, or a small piston and cylinder device 51 which is extended against the outside of the jaw 48 to prevent opening thereof.

30

Fig. 7 is a schematic circuit diagram of a hydraulic circuit 60 suitable for use in operation of the variably extendible support rams 2, 4. The circuit comprises a reservoir 61, electrically driven 62 pump 63, supply and return lines 64, 35 65, connected to the variably extendible support rams 2, 4 via supply valves 66, and non-return valves 67. The rams 2, 4 are

-11-

provided with limit switches 68 which are connected to an electrical control panel 69 along with actuators 70 for the supply valves 66. An electrical power supply 71 is also connected via the control panel 69 the pump motor 62. A
5 cooler 72 is included in the hydraulic circuit 60 to prevent overheating of the pressurised fluid and is also provided with electrical connections 73 to the control panel 69 for controlling operation thereof.

10 It will be appreciated that various modifications may be made to the above-described embodiments without departing from the scope of the present invention. Thus, for example, one or both of the single-acting rams 2, 4 in Fig. 7 could be replaced by double-acting rams.

15

Various modifications may be made to the above described embodiments without departing from the scope of the present invention.

-12-

CLAIMS

1. A lifting apparatus with variable and independently selectable height and reach which lifting apparatus comprises a base supporting a lifting means, said lifting means
5 comprising at least two upwardly extending variably extendible support means; an arm having a proximal end portion and an intermediate portion, which portions are pivotally connected, directly or indirectly, to an upper end portion of respective ones of said variably extendible support means; and a load
10 support means depending from a distal end portion of the arm, each of said at least two variably extendible support means being provided with drive control means formed and arranged for extending and retracting each said variably extendible support means relative to each other for controlling
15 translational movement of the arm wherein the reach and elevation of the lifting apparatus may be altered substantially independently of each other by selective extension and/or retraction of each said variably extendible support means whereby a load depending from the distal end of
20 said arm can be selectively and independently moved in generally vertically and/or horizontally extending directions.
2. A lifting apparatus as claimed in claim 1 wherein said drive control means are in the form of pressurised fluid rams.
25 provided with drive means for extending and/or retracting the rams.
3. A lifting apparatus as claimed in claim 1 wherein said drive control means are in the form of a mechanical system
30 selected from: a rack and pinion system, and winch and pulley systems, each said mechanical system being provided with drive means and control means.
4. A lifting apparatus as claimed in any one of claims 1 to 3
35 wherein the variably extendible support means are formed and

-13-

arranged to provide a maximum elevation of the load support means in the range of from 1.5 to 3.0 m.

5. A lifting apparatus as claimed in any one of claims 1 to 4
5 wherein the base of the lifting apparatus is provided with powered and/or unpowered wheels, or other ground engaging means formed and arranged to facilitate relocation of the lifting apparatus.

10 6. A lifting apparatus as claimed in any one of claims 1 to 5 wherein the arm has a length of from 0.5 to 2.0 m.

7. A lifting apparatus as claimed in any one of claims 1 to 6
15 wherein the footprint of the base is formed and arranged so as to extend substantially underneath the centre of gravity of the apparatus when said arm is loaded with a predetermined maximum load.

8. A lifting apparatus as claimed in any one of claims 1 to 7
20 wherein said drive control means has a user interface in the form of a control panel located on the base and/or a remote control device coupled to the variably extendible drive means.

9. A lifting apparatus as claimed in any one of claims 1 to 8.
25 wherein the variably extendible support means drive control means is formed and arranged to provide a maximum lifting capacity in the range from 150 to 250 Kg when the arm is fully extended.

30 10. A lifting apparatus as claimed in any one of claims 1 to 9 wherein the arm is directly and pivotally connected to the respective upper end portions of the at least two variably extendible support means.

35 11. A lifting apparatus as claimed in any one of claims 1 to 10 wherein said at least two variably extendible support means

-14-

comprise at least one each of a main variably extendible support means and a secondary variably extendible support means whereby the main variably extendible support means provides the main load bearing support for the lifting
5 apparatus.

12. A lifting apparatus as claimed in claim 11 wherein the main variably extendible support means provides the main load bearing support for the arm via a support link which is
10 pivotably connected across the upper end of the main variably extendible support means and said intermediate portion of the arm; and the said secondary variably extendible support means is pivotally connected to a proximal end portion of the arm, via an arm end portion pivotal connection, the height and
15 reach of the lifting apparatus being adjustable by altering the degree to which the main and secondary variably extendible support means are extended relative to each other.

13. A lifting apparatus as claimed in claim 12 wherein said
20 arm end portion pivotal connection means is formed and arranged so as to be selectively disconnectable so that, in use of the apparatus, the main and the secondary variably extendible support means and the arm may be retracted and stowed within said base of the lifting apparatus: by extending
25 the main variably extendible support means to its fullest extent while simultaneously retracting the secondary variably extendible support means so that said arm pivots downwardly about its proximal end which is attached to said upper end portion of the secondary variably extendible support means to
30 a collapsed position wherein said arm lies along side the secondary variably extendible support means with the main and secondary variably extendible support means and the arm substantially parallel to each other; said arm end portion pivotal connection being disconnected to allow each of the
35 main and the secondary variably extendible support means and

-15-

arm to be fully retracted by the drive control means within said base of the lifting apparatus.

14. A lifting apparatus as claimed in claim 13 wherein said
5 selectively disconnectable arm end pivotal connection means comprises pivot pin means and pin catch means having jaws provided with resilient biasing means for urging said jaws towards each other into a substantially closed position for captive engagement around said pivot pin means, said jaws
10 being formed and arranged so that at least one is displaceable towards an open position by driving of the pivot pin means into or out of engagement with said pin catch means.

15. A lifting apparatus according to claim 14 wherein said
15 base is provided with guide means formed and arranged for guiding engagement with said proximal arm end: upon retraction of said arm into the base following disengagement of said pivot pin from said catch means, so as to laterally displace said arm for stowage thereof alongside said secondary variable
20 extendible support means; and upon deployment of said arm out of said base so as to restore said pivot pin into a pin catch means - engaging position for engagement therewith upon extension of the secondary variably extendible support means out of the base.

25

16. A lifting apparatus according to claim 14 or 15 wherein said pin catch means is provided with locking means formed and arranged for locking said jaws into their closed position at least during use of the apparatus for lifting or lowering of a
30 load.

17. A lifting apparatus according to claim 16 wherein said base is provided with a latching/unlatching device formed and arranged for actuation of said pin catch means so as to allow
35 opening thereof to permit opening of said jaws for disengagement or engagement of the pin means with the pin

-16-

catch means when said variably extendible support means and said arm are fully retracted into the base or extended out therefrom.

5 18. A lifting apparatus as claimed in any one of claims 1 to 17 wherein said load support means at the distal end of the arm comprises a patient support harness.

19. A lifting apparatus as claimed in any one of claims 1 to 10 18 wherein the base is supported on a turntable for rotation of the lifting apparatus through at least 90°C.

20. A lifting apparatus as claimed in any one of claims 1 to 19 wherein the lifting apparatus is provided with a 15 plurality of retractable stabiliser legs or stays which can be deployed in use of the apparatus when required to provide additional security against overbalancing.

1/4

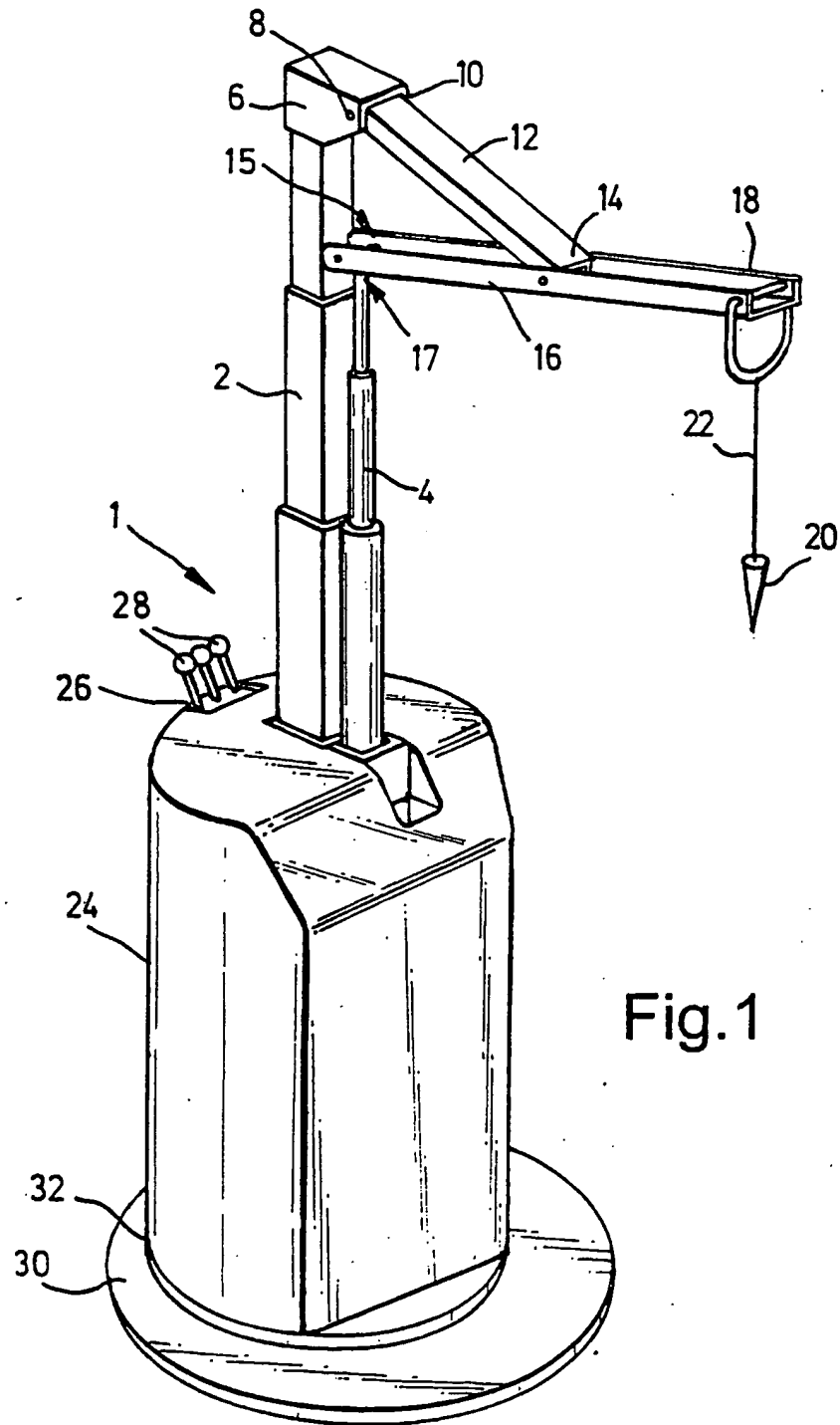
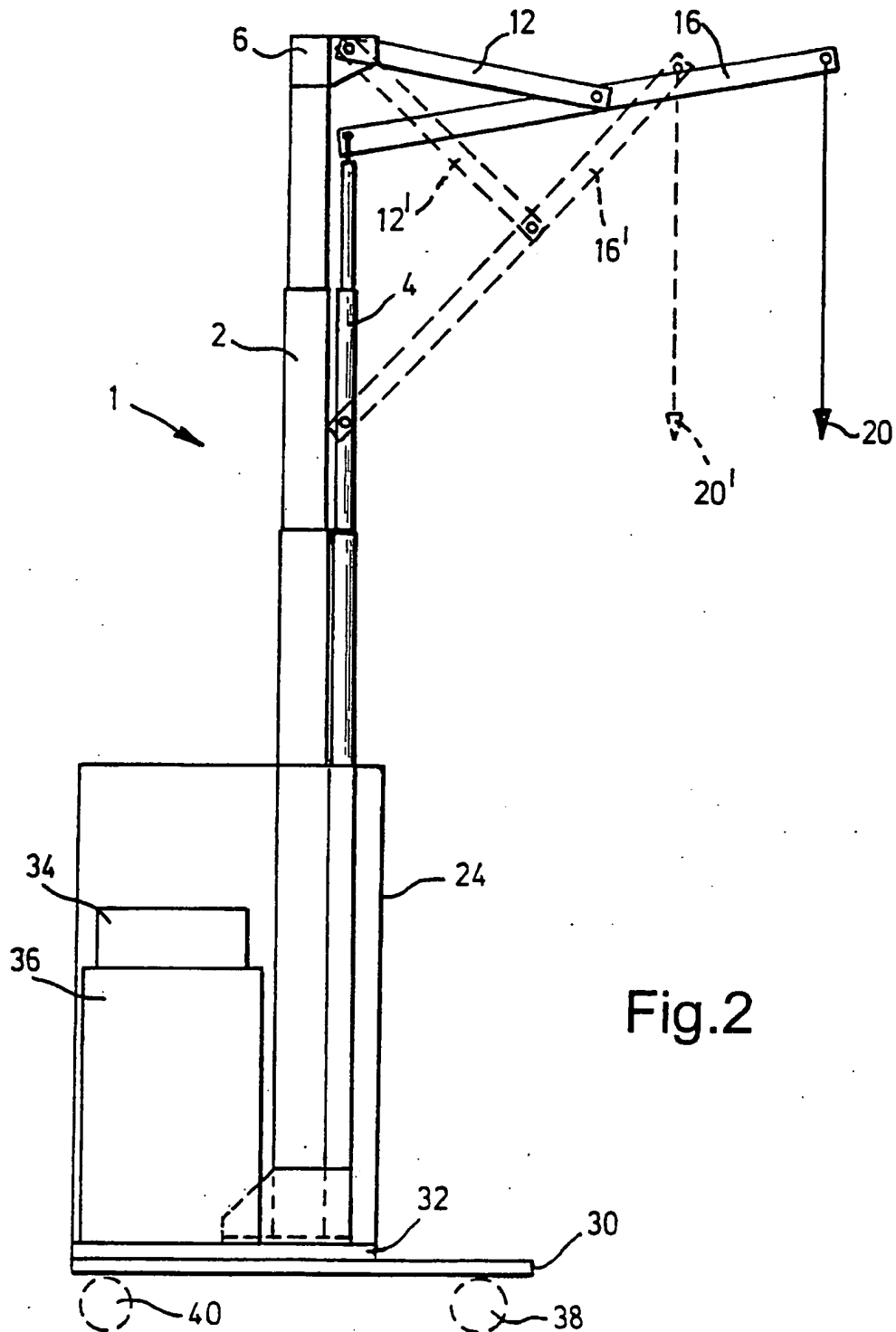


Fig.1

2/4



3/4

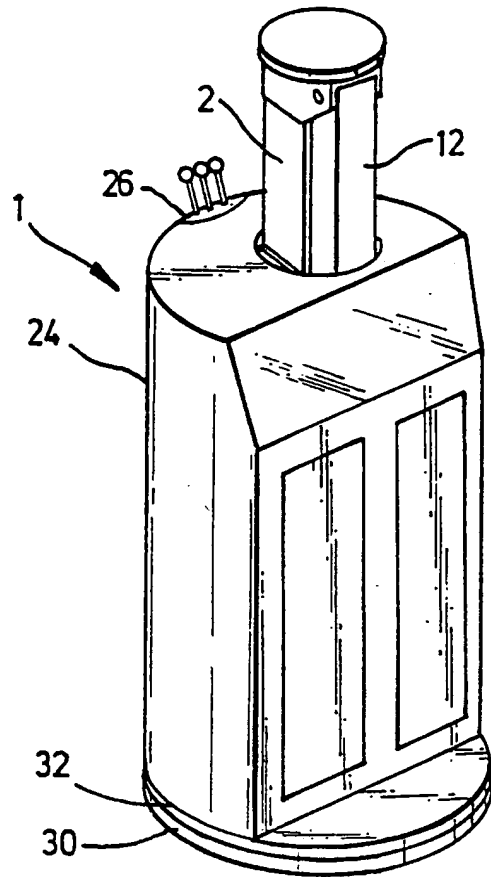


Fig.3

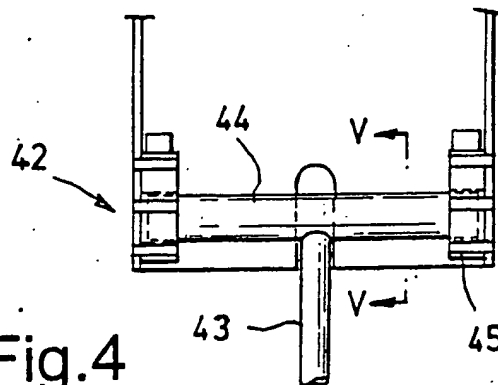


Fig.4

4/4

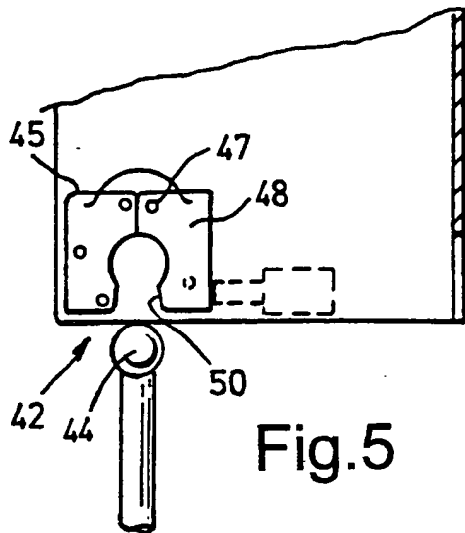


Fig. 5

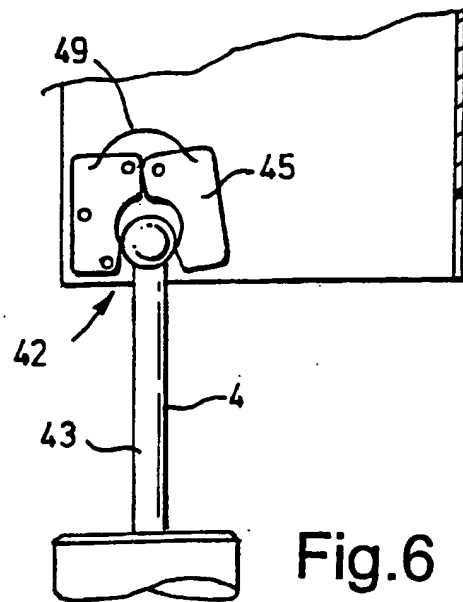


Fig. 6

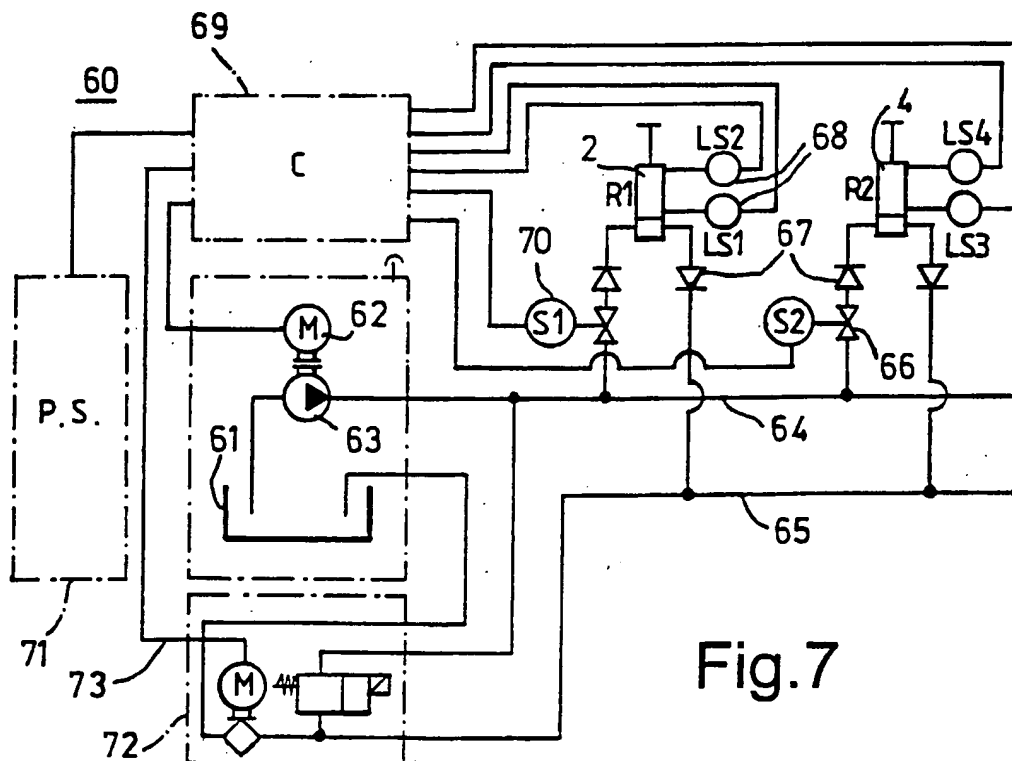


Fig. 7

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/01764

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A61G7/10 B66F9/06 B66C23/48

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61G B66F B66C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 459 891 A (REEVE RICHARD J ET AL) 24 October 1995 (1995-10-24) column 7, line 27 - line 33 column 8, line 12 - line 21; figures	1
A	GB 2 297 307 A (ARJO LTD) 31 July 1996 (1996-07-31) abstract; figures	1
A	GB 840 419 A (HYDRAULISKA INDUSTRI AKTIEBOLAGET) 6 July 1960 (1960-07-06) page 2, line 22 - line 37; figures	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

Z document member of the same patent family

Date of the actual completion of the international search

15 August 2000

Date of mailing of the international search report

21/08/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Cametz, C

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/01764

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5459891	A	24-10-1995	NONE
GB 2297307	A	31-07-1996	AT 165968 T 15-05-1998
			AT 175574 T 15-01-1999
			AU 689556 B 02-04-1998
			AU 1900895 A 29-11-1995
			AU 690734 B 30-04-1998
			AU 3395195 A 14-08-1996
			CA 2189956 A 16-11-1996
			DE 69502494 D 18-06-1998
			DE 69502494 T 05-11-1998
			DE 69507342 D 25-02-1999
			DE 69507342 T 26-08-1999
			EP 0758878 A 26-02-1997
			EP 0805668 A 12-11-1997
			WO 9530400 A 16-11-1995
			WO 9622757 A 01-08-1996
			GB 2289457 A, B 22-11-1995
			JP 10512459 T 02-12-1998
			JP 9512726 T 22-12-1997
			NO 964761 A 09-01-1997
			NO 971435 A 25-03-1997
			US 5784729 A 28-07-1998
			US 5845348 A 08-12-1998
			ZA 9508589 A 14-05-1996
GB 840419	A	NONE	

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☐ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☒ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.